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INFORMATION RETRIEVAL PROGRAMS IR8-IR9*

By

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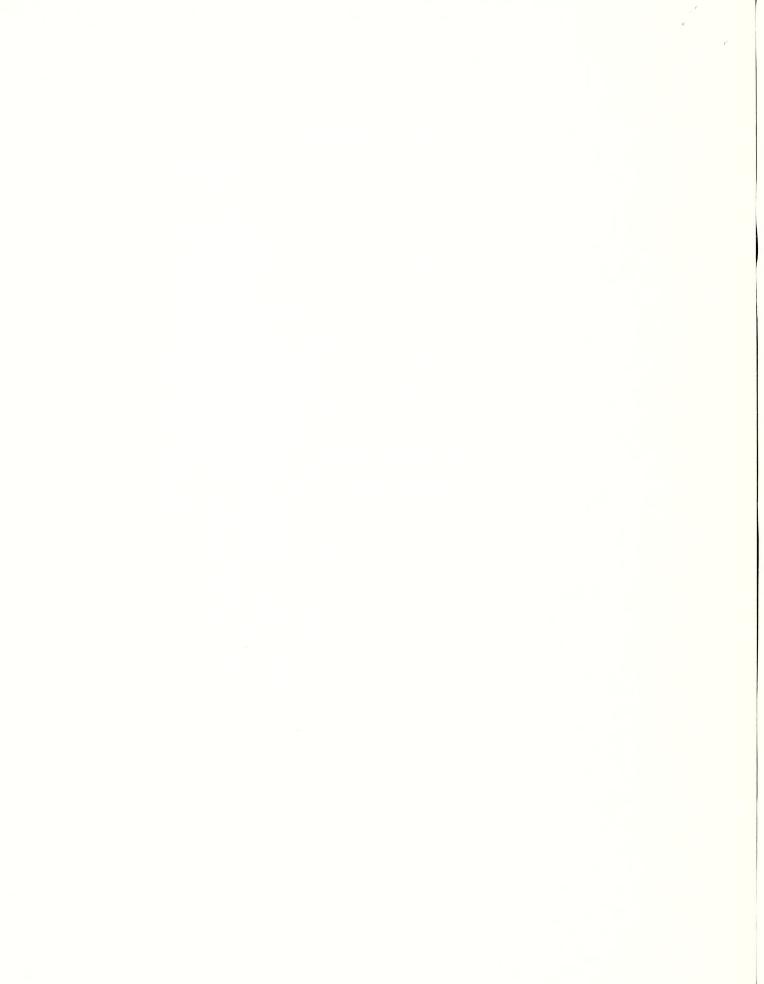
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*The programs are written specifically for the CDC 6600 Computer at the Brookhaven National Laboratory, Upton, N.Y., using FORTRAN IV, COMPASS and SCOPE 3 languages.

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1. INTRODUCTION

The programs described in this report are complementary to the IR6
Laboratory Record Retrieval Program and the IR7LIT literature retrieval
program. The programs are mainly written for a more economical usage
of large files. Because of the length of time involved in reading
large numbers of records (which increases costs) the programs are kept
as short as possible (which reduces costs). Unlike the IR6 or IR7LIT
programs, only a limited number of operations are combined into one
program (1,2). However, several programs can be executed in one job,
since between the programs the data files are maintained on magnetic
disk.

All programs are made available by the standard IR program call deck
and are loaded and executed by the SCOPE cards:

> COMMON (program name)
> Program name.

The programs use a disk file called DISK as the input device. The
procedures for copying input onto DISK are detailed in the IR6 report,
Sect. 3. The control cards are similar to those of the IR6 program.
The last control card should be

> END*OF*JOB

In Sect. 9, the deck structure for two commonly-used tape copy operations
is described and in Sect. 10 an example is given of combining some of
the programs described in this report into one job. Finally, in Sect. 11,
the use of COMMON files is described for linking two different jobs.

2. PRINTING OF DATA RECORDS (IR8PRNT program)

With the IR8PRNT program, the user has four options from which to choose the format of the output. These options are selected by control cards very similar to the control cards of the IR6 program:

<div align="center">

PRINT*****
PRINT*WITH*DELETIONS
PRINT*LITERATURE
PRINT*KEYWORDS

</div>

The first 10 characters (columns 1-10) of these control cards direct the computer to the requested option. With the PRINT***** control card the output is as follows: number of record, followed by the full record image.

With the PRINT*WITH*DELETIONS, the print-out is similar to the standard print-out of IR6. With PRINT*LITERATURE, the print-out is similar to the IR7LIT output. The PRINT*KEYWORDS control card can be used to print out tapes with keywords. Repeated keywords will be deleted.

All control cards must be followed by a detail card indicating the section of the file to be printed. The number of the first records to be printed is in columns 11-20 of the detail cards. The number of the last records to be printed is in columns 21-30. Several control cards with detail cards can be used to request printing of different sections of the file. For instance, the control and detail cards in the following example will produce a print-out of records 1-50, 300-500 and 560-1000-- the first two sets in the full card image format, the last set in the IR6 format. The record numbers must be in ascending order. No duplicated numbers can be requested.

Deck structure:

```
Job card                                        (Field length 25)
Program call deck
REQUEST, TAPE, 8, Y, R, A2433.  PLUM ISLAND
COPYCF (TAPE, DISK)
REWIND (TAPE, DISK)
RETURN (TAPE)
COMMON (IR8PRNT)
IR8PRNT.
7/8/9 card
PRINT*****
                    1         50
PRINT*****
                  300        500
PRINT*WITH*DELETIONS
                  560       1000
6/7/8/9 card
```

With the control card

NEW*PAGE**

prior to the control card PRINT*WITH*DELETIONS, each experiment will start
on a new page.

3. SELECTING OF FILE SECTIONS (IR8FILE program)

With this program, sections of a file can be transferred to a
disk file (FILES) as separated files. The last record number of
each file to be transferred is punched in columns 11-20 of a detail
card. The maximum number of detail cards is nine.

Deck structure:

```
Job card                                    (Field length 25)
Program call deck
REQUEST, TAPE, 8, Y, R, A2433.  PLUM ISLAND
COPYCF (TAPE, DISK)
REWIND (TAPE, DISK)
RETURN (TAPE)
COMMON (IR8FTLF)
IR8FILE.
REWIND (FILES)
COPYCF (FILES, DUMMY)
REQUEST, TAPE, 8, Y, R, W, A404.  PLUM ISLAND
COPYCF (FILES, TAPE)
REWIND (TAPE)
RETURN (TAPE)
REQUEST, TAPE, 8, Y, W, A603.  PLUM ISLAND
COPYCF (FILES, TAPE)
7/8/9 card
                     200
                    2000
                   10000
END-OF-JOB
6/7/8/9 card
```

Records 201-2000 will then be on tape A404, and records 2001-10000
will be on tape A603.

4. SELECTING OF RECORDS (IR8SELT program)

With this program, records can be selected from a file and transferred to disk files called SELECT1, SELECT2------SELECT9. The control cards are:

        ACCEPT******
        REJECT******

and are used in the same manner as those in IR6, Sect. 4.2. The select detail cards have the same format as those of the IR6 program (see IR6, Sect. 4.2). Each record will be checked against each of the detail cards. With the ACCEPT****** control card, records matching with the first detail card will be placed in SELECT1, with the second detail card in SELECT2, etc. With the REJECT****** control card, the records not matching will be transferred to SELECT1, etc. The maximum number of select detail cards is nine.

Deck structure:

Job card   (Field length 35)
Program call deck
REQUEST, TAPE, B, Y, R, A2423. PLUM ISLAND
COPYCF (TAPE, DISK)
REWIND (TAPE, DISK)
RETURN (TAPE)
COMMON (IR8SELT)
IR8SELT.
REWIND (SELECT1, SELECT2-----------)
REQUEST, TAPE, B, Y, W, A0165. PLUM ISLAND
COPYCF (SELECT1, TAPE)
REWIND (TAPE)
RETURN (TAPE)
REQUEST, TAPE, B, Y, W, A2424. PLUM ISLAND
COPYCF (SELECT2, TAPE)
7/8/9 card
ACCEPT******
******40******RLT***
*************SEK***
**********EOR
6/7/8/9 card

Records with 45 in columns 4 and 5, and RLT in columns 12-14, will be on tape A0165, and records with SEK in columns 17-19 will be on tape A2424.

5. SORTING OF RECORDS (IR8SORT program)

With this program, the records of a file can be sorted. The user has two options similar to the sort options of the IR6 program. The control and detail cards are identical:

SORT****** (followed by a detail card)
SORT*CODE*DATE*FORM

The first control card must be followed by a sort detail card indicating in which order the columns of the records are to be sorted (see IR6, Sect. 5/p. 1).

The second control card is used when the file has to be sorted by the first 20 columns. This sort is considerably faster than the first option and requires no detail card.

After the sort, the records will be written on a disk file called SORT.

Deck structure:

```
Job card                       (Field length and ECS, see following tables)
Program call deck
REQUEST, TAPE, 8, Y, R, A165.  PLUM ISLAND
COPYCF (TAPE, DISK)
REWIND (TAPE, DISK)
RETURN (TAPE)
COMMON (IR8SORT)
IR8SORT.
REWIND (SORT)
REQUEST, TAPE, 8, Y, R, A2429.  PLUM ISLAND
COPYCF (SORT, TAPE)
7/8/9 card
SORT****** (followed by detail card)
    22222    111111
END*OF*JOB
6/7/8/9 card
```

Request Field Length for Central Memory for IR8SORT

On the job card in columns 18-20, a request is made for space in the central memory. The number to be punched in these columns is

the number of octal thousands of computer words required. The following
table can be used:

Maximum number of records	Columns		
	18	19	20
2000		4	0
3000		4	5
4000		5	5
5000		6	0
6000		7	0
7000		7	5
9000	1	1	0
10000	1	1	5
12000	1	2	5

Request for ECS IR8SORT

On the job card in columns 31-33, a request is made for storage space in the ECS. The number to be punched in these columns is the number of octal thousands of computer words required. The following conversion table can be used:

Number of records	Columns		
	31	32	33
100			2
500		1	0
1000		2	0
2000		4	0
3000		6	0
4000	1	0	0
5000	1	2	0
6000	1	4	0
8000	2	0	0
10000	2	4	0
12000	3	0	0
15000	4	0	0

Fifteen thousand records use up all the available storage space in ECS and thus is the maximum number of records that can be accepted.

6. MERGING OF SEQUENTIAL FILES (IR8MERG program)

With this program, the user can merge two sequential files. These files must be copied onto the disk files DISK and MERGE. The merged records will be written on a disk file called MERGED. The program has two control cards:

MERGE***** (followed by a detail card)
MERGE*CODE*DATE*FORM

The first control card must be followed by a merge detail card similar to the sort order cards of the IR6 or the IR8SORT program (see IR6, Sect. 5/p. 1). This detail card indicates by which columns the files are sequential.

The second control card is used when DISK and MERGE are sequential according to the first 20 columns of the records. This second option is much faster than the first option.

The program checks if each of the files to be merged is sequential and will print out an error message when the first two records are found to be out of order. Other records out of order will be switched. In the next example, it was assumed that the tapes to be merged were produced by the IR8SORT program with the job as shown in that section

Deck structure:

```
Job card                                    (Field length 25)
Program call deck
REQUEST, TAPE, 8, Y, R, A2429.  PLUM ISLAND
COPYCF (TAPE, DISK)
REWIND (TAPE, DISK)
RETURN (TAPE)
REQUEST, TAPE, 8, Y, R, A165.  PLUM ISLAND
COPYCF (TAPE, MERGE)
REWIND (TAPE, MERGE)
RETURN (TAPE)
COMMON (IR8MERG)
IR8MERG.
REWIND (MERGED)
REQUEST, TAPE, 8, Y, W, A1972.  PLUM ISLAND
COPYCF (MERGED, TAPE)
7/8/9 card
MERGE***** (followed by detail card)
     22222     111111
END*OF*JOB
6/7/8/9 card
```

7. CHANGING OF RECORDS IN A FILE (IR8CORR program)

This program has the following cards:

DELETE****
REPLACE***

The delete and replace control cards are both followed by a detail card with the number of the record to be changed in columns 11-20. With the DELETE**** control card this record will not be written on the disk file CORRECT. The replace detail card is followed by a card with the new record. The old record will be deleted and the new record written in its place on the disk file CORRECT.

Delete and replace control cards may be used in any order but the number in the detail cards must be in ascending order. No duplication of numbers must occur.

Deck structure:

```
Job card                              (Field length 25)
Program call deck
REQUEST, TAPE, 8, Y, R, A2433.  PLUM ISLAND
COPYCF (TAPE, DISK)
REWIND (TAPE, DISK)
RETURN (TAPE)
COMMON (IR8CORR)
IR8CORR.
REWIND (CORRECT)
REQUEST, TAPE, 8, Y, W, A165.  PLUM ISLAND
COPYCF (CORRECT, TAPE)
7/8/9 card
DELETE****
                 10
                150
                151
CORRECT***
                773
New record
CORRECT***
                832
New record
DELETE****
                938
END*OF*JOB
6/7/8/9 card
```

8. CORRECTING OF PUNCH CARDS (IR9CRD program)

Sometimes repeated errors on several punch cards occur (mostly caused by an error in the input sheets and not by a mistake of the key punch operator!). Correction of such cards is tedious on the key punch but can be done efficiently with the IR9CRD program. The program can also be used for changing the format of records. If the user does not want to have the new records punched on cards, but transferred to magnetic tape instead, the output disk PUNCH should be rewound and copied onto the tape, followed by a release of PUNCH.

The program has two control cards:

                    PUNCH*****
                    SWITCH****

The control card PUNCH***** is followed by detail cards with, in column 1, the character to be punched in the new record, and in columns 19-20, the column to be changed. The control card SWITCH**** is followed by detail cards with the numbers of the columns to be switched in columns 19-20 and columns 29-30.

Deck structure:

Job card   (Field length 25)
Program call deck
COPYCF (INPUT, DISK)
REWIND (DISK)
COMMON (IR9CRD)
IR9CRD.
7/8/9 card
Data cards
7/8/9, 1,7 card
PUNCH*****
S   17
E   18
R   19
END*OF*JOB
6/7/8/9 card

The new cards will have a SER punched in columns 17-19.

9. READING OF RECORDS ONTO MAGNETIC TAPE

    (A) Replacing previous records or using a new tape. This operation is done with SCOPE system cards with the following deck structure:

Job card   (Field length 5)
REQUEST, TAPE, 8, Y, W, A2433. PLUM ISLAND
COPYCF (INPUT, TAPE)
7/8/9 card
Data deck
7/8/9, 1,7 card   (see IR6, Sect. 3)
6/7/8/9 card

    (B) Adding records to records on the tape. This operation is also done with SCOPE system cards with the following deck structure:

Job card   (Field length 5)
REQUEST, TAPE, 8, Y, R, A2433. PLUM ISLAND
COPYCF (TAPE, DISK)
BKSP (DISK)   (see IR6, Sect. 3)
COPYCF (INPUT, DISK)
REWIND (TAPE, DISK)
RETURN (TAPE)
REQUEST, TAPE, 8, Y, W, A0106. PLUM ISLAND
COPYCF (DISK, TAPE)
7/8/9 card
Data deck
7/8/9, 1,7 card
6/7/8/9 card

10. COMBINING IR PROGRAMS INTO ONE JOB

      The following is an example of a deck structure for a job using
the IR8FILE, IR8SORT and IR8PRNT programs.

Job card   (Field length maximum required for any of the programs--
                in this case, IR8SORT with a field length of 35)
Program call deck
REQUEST, TAPE, 8, Y, R, A165. PLUM ISLAND
COPYCF (TAPE, DISK)
REWIND (TAPE, DISK)
RETURN (TAPE)
COMMON (IR8FILE)
IR8FILE.
REWIND (FILES, DISK)
COPYCF (FILES, DISK)
REWIND (DISK)
COMMON (IR8SORT)
IR8SORT.
REWIND (SORT, DISK)
COPYCF (SORT, DISK)
REWIND (DISK)
COMMON (IR8PRNT)
IR8PRNT.
REWIND (DISK)
COPYCF (FILES, DISK)
REWIND (DISK)
IR8PRNT.
7/8/9 card
                    2000 $\left.\right\}$ control cards for IR8FILE
                    3000
END*OF*JOB
7/8/9 card
SORT****** $\left.\right\}$ control cards for IR8SORT
      22222   111111
END*OF*JOB
7/8/9 card
PRINT*WITH*DELETIONS $\left.\right\}$ control cards 1st print
                      1   2000
END*OF*JOB
7/8/9 card
PRINT***** $\left.\right\}$ control cards 2nd print
                      1   1000
END*OF*JOB
6/7/8/9 card

11. USING COMMON FILES

Normally, a file is dropped at the end of a job. By using a SCOPE card

COMMON (file name)

the file is maintained on a disk and is available for following jobs. The same card also requests the file in the next job. This makes it possible to link jobs without the need of first copying a resultant file onto a magnetic tape.

Notes

1. Common files do not survive the dead starts which normally occur at least once every 24 hours.

2. The computer facilities at the Brookhaven National Laboratory consist of two independent 6600 computers (the A system and the B system). At present, a common file generated by one system will only be available in that system.

3. A common file must be assigned to a disk before use. This is done with the SCOPE card

ASSIGN, file name, *AC.

The user can choose the file name; *AC. is part of the SCOPE system.

4. A common file should be rewound before re-use.

The following is an example of the use of a common file SORT created by IR8SORT and printed by IR8PRNT program.

```
Job card
Program call deck
REQUEST, TAPE, 8, Y, R, A109.   PLUM ISLAND
COPYCF (TAPE, DISK)
REWIND (TAPE, DISK)
RETURN (TAPE)
ASSIGN, SORT, *AC.
COMMON (IR8SORT)
IR8SORT.
COMMON (SORT)
7/8/9 card
IR8SORT control cards
6/7/8/9 card
```

The file SORT is now in common and can be used for further jobs:

Job card
Program call deck
COMMON (SORT)
REWIND (SORT)
COPYCF (SORT, DISK)
REWIND (SORT, DISK)
COMMON (IR8PRNT)
IR8PRNT.
RELEASE (SORT) (if SORT is not further needed)
7/8/9 card
PRINT*WITH*DELETIONS
                          1   100
END*OF*JOB
6/7/8/9 card

REFERENCES

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